

The Relationship between Explanatory Ability and Collegiate Learning Assessment Task

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ARTICLE INFORMATION	ABSTRACT
<p>Article History:</p> <p>Accepted: 23-05-2022 Approved: 14-02-2023</p> <hr/> <p>Keywords:</p> <p><i>explanation;</i> <i>CLA Task;</i> <i>collegiate learning assessment</i></p> <hr/> <p>Authors Correspondence:</p> <p>Monika Lintang Laksmi Biology Education Universitas Sebelas Maret Ir Sutami St, Number 36, Surakarta, Central Java, 57126, Indonesia E-mail: monikalintang@student.uns.ac.id</p>	<p>The literature study discusses the relationship between explanatory ability and Collegiate Learning Assessment (CLA) Task. The method used is a study of the literature related to explanatory ability and CLA Task, the literature studied from 2015 to 2022. The literature study results are CLA Task with an open-ended question, problem-based situations, and problem-solving can be used as an assessment of explanatory abilities that consist of indicators for justifying procedures, state result, and present explanation. The achievement of the three indicators of explanatory ability that will be empowered with CLA Task needs the help of electronic module for media learning.</p>

An explanation is the ability to express and provide reasoning in terms of evidence, concepts, methodologies, criteria, contextual, and present a reason (Facione, 2015). The explanation explains real problems and solutions to the problem or phenomena (McCain, 2015). Explanation capability indicators include: justify procedures, state results, and present arguments or explanations (Facione, 2015). Explanatory ability is inseparable from the skills of students in critical thinking. Assessment of the explanatory ability is related to the characteristics of critical thinking skills: the use of information, conducting analysis, and conducting evaluations (Aizikovitsh-Udi & Cheng, 2015). The ability to critically prepared explanations by students is still relatively low. The lack of explanatory abilities can be due to several factors, among others: teachers are not able to integrate the characteristics of critical thinking skills into the learning process (Choy & Oo, 2012), students do not know the components of explanation, difficulty communicating understanding in the form of writing, difficulty developing ideas, and have not been able to compose the explanation text effectively and correctly (Melisa et al., 2019). Explanatory abilities need to be improved because they help analyze and interpret a discussion in science learning (Osborne et al., 2004), involving students to conduct investigations directly (Gotwals & Songer, 2013), and train students' critical thinking skills (Suwono et al., 2017). Students who can compose an explanation have a good understanding, can identify a mechanism and pattern, make predictions, and exercise control over an event (Hochstein, 2017).

Improved explanatory abilities can be done by training students to find solutions based on actual and ill-structured problems, conducting investigations, and decisions or solutions based on students' mindsets (Hitchcock, 2017). Students can build real issues and solutions through a Collegiate Learning Assessment (CLA) Performance Task assignment (Schendel & Tolmie, 2017). CLA Task is an assignment with a level of higher education assessment based on problem-based situations, open questions, and information materials to be analyzed (Hyytinen et al., 2015). This literature study reveals the relationship between explanation capabilities and collegiate learning assessment (CLA) Performance Task. The relationship between explanatory ability and CLA Task is reviewed based on each component, so those appropriate learning innovations can be found to improve explanation capabilities using CLA Task.

METHOD

The method used is a literature review related to explanatory abilities and CLA tasks. Determine the scope of research to select the literature to be studied. The initial literature obtained is selected based on predetermined criteria, namely (1) English-language and internationally reputable articles; (2) published in scientific journals in the field of education and science; (3) use keywords: explanation, explanatory, collegiate learning assessment, and CLA Task; 4) from 2015 to 2022. Literature obtained based on criteria amounted to approximately 100 articles, but after analysis based on abstracts, keywords, and discussions, I received 40 articles that can use as study materials following the purpose of research. Each piece of literature will be displayed in Appendix A and discussed in the article's result and discussion section.

The discussion of the article discusses the study of components of the explanation capability and CLA task. Each component in the explanation capability is examined in relation to the assessment using the CLA Task. The linkage between the explanation ability assessed and the CLA Task will be obtained with learning innovations.

RESULT AND DISCUSSION

This study discusses the relationship between explanation capabilities and CLA Task. The literature is analyzed by linking CLA task components consisting of problem-based situations, open-ended questions, and problem-solving to measure three explanation capabilities indicators: structuring procedures, describing results, and providing explanations. The total of articles used in the literature study was 40 in detail can be seen in table 1.

Table 1. Literature Review's Articles List

No	Author	Title	Year	Reviews
1	McCain, Kevin	Explanation and the Nature of Scientific Knowledge	2015	An explanation explains natural phenomena, explaining the occurrence of phenomena or problem-solving in phenomena.
2	Brigandt, Ingo	Why the Difference Between Explanation and Argument Matters to Science Education	2016	Explanation and argumentation skills are two different abilities.
3	Utami, B., Saputro, S., Ashadi, & Masykuri, M.	Performance Assessment to Measure Students' Explanations in Chemistry Learning	2020	Reasoning in explanation requires solving problems, making decisions, analyzing, interpreting, or evaluating.
4	Facione, Peter A.	Critical Thinking: What It Is and Why It Counts	2015	Explanation indicators are describing results, putting together procedures, and stating explanations.
5	Roth, Paul A.	Essentially Narrative Explanations	2017	An explanation can take the form of a narrative used to explain a particular question, write down a reason, and inform an assessment of a problem.
6	Morgan, Mary S.	Narrative Ordering and Explanation	2017	Explanations prepared based on evidence must be found through the analysis stage of scientific methods.
7	Beatty, John	Narrative Possibility and Narrative Explanation	2017	Explanation relates to a person's critical ability to explain an event and the reason it can occur, not about the possibility that it will happen.
8	Serrano, J. S., Carrasco, C. J. G., & Facal, R. L.	Historical Thinking, Causal Explanation and Narrative Discourse in Trainee Teachers in Spain	2018	The explanation requires sources of information (facts), research methods, reflections, and reasoning.
9	Olmos, Paula	Revisiting Accounts of Narrative Explanation in the Sciences: Some Clarifications from Contemporary Argumentation Theory	2020	The success of an explanation relates to problem identification and problem-solving.
10	Suwono, H., Pratiwi, H. E., Susanto, H., & Susilo, H.	Enhancement of Students' Biological Literacy and Critical Thinking of Biology Through Socio-Biological Case-Based Learning	2017	Explanation capabilities are related to facts, cases, and determining solutions.
11	Cristalli, Claudia	Narrative Explanations in Integrated History and Philosophy of Science	2019	The problems faced in the preparation of an explanation must be accurate.
12	Kurniawan, Ilma, Putri, & Hartono	Developing Open-Ended Questions for Surface Area and Volume of Beam	2018	The preparation of the procedure in explanation is written according to reasoning and can be done if given an open question.
13	Povich, Mark	Information and Explanation: An Inconsistent Triad and Solution	2021	Problem-solving solutions built into explanation must be based on actual problems and disclosed based on existing information or evidence.
14	Fisher, Matthew, & Keil, Frank C.	The Curse of Expertise: When More Knowledge Leads to Miscalibrated Explanatory Insight	2015	Understanding in explanation is an important component of cognitive and underlying categorization, diagnosis, and induction processes.
15	Magiera, Marta T., & Zambak, Vecihi S.	Exploring Prospective Teachers' Ability to Generate and Analyze Evidence-based Explanatory Arguments	2020	Making an explanation does not just provide a simple description of the procedure, but rather to clarify aspects of thought and articulates it. Making an explanation involves producing and evaluating activities to establish evidence-based reasons.
16	Davidoff, Frank	Understanding Contexts: How Explanatory Theories can Help	2019	The principle of explanation is to transfer the meaning of an event or situation, build logic, unify

				the information components in the event, and compose an explanation according to the purpose.
17	Hochstein, Eric	Why One Model is Never Enough: A Defense of Explanatory Holism	2017	A good explanation will result in understanding, identifying mechanisms, making predictions, identifying patterns, and making it possible to control and manipulate phenomena.
18	Palupi, B. S., Subiyantoro, S., & Rukayah, T.	Creative-Thinking Skills in Explanatory Writing Skills Viewed from Learning Behaviour: A Mixed Method Case Study	2020	Explanation text includes providing solutions on how to handle an event.
19	Petkov, Stefan	Explanatory Unification and Conceptualization	2015	An explanation is an explanation of a series of phenomena that are argumentative. The phenomenon described stems from the problem.
20	Kramnick, Jonathan, & Nersessian, Anahid	Form and Explanation	2017	An explanation is an answer to the question, especially "why." An explanation is relative and related to existing information. An explanation is not pure science but rather the application of science that forms descriptive information.
21	Di Nuoscio, Enzo	On the Explanation of Human Action: "Good Reasons," Critical Rationalism and Argumentation Theory	2018	The purpose of explanation is to indicate a person's reason for doing something, so there must be an evaluation element in the explanation.
22	Kaplar, M., Luzanin, Z., & Verbic, S.	Evidence of Probability Misconception in Engineering Students - Why Even an Inaccurate Explanation is Better Than No Explanation	2021	The preparation of an explanation can be done when students are given an open question.
23	Valeria M. Cabello, & Keith J. Topping	Pre-service Teachers' Conceptions About the Quality of Explanations for the Science Classroom in the Context of Peer Assessment	2020	An explanation can be understood as a complex process of representation of knowledge possessed by learners.
24	Geelan, David	Physical Science Teacher Skills in a Conceptual Explanation	2019	Explanation in science learning is used to explain the reasons for natural phenomena.
25	Palupi, B. S., Subiyantoro, S., Rukayah, & Triyanto	The Effectiveness of Guided Inquiry Learning (GIL) and Problem-Based Learning (PBL) for Explanatory Writing Skill	2020	An explanation describes the statement on "why" and "how" elements relevant to natural phenomena, social life, science, and culture.
26	Shavelson, Richard J.	The Collegiate Learning Assessment	2008	CLA Task is an assessment with many alternative answers that students can make, thus enabling students' ability to analyze real complex problem solving and communicate it correctly.
27	Klein, Stephen, & Benjamin, Roger	The Collegiate Learning Assessment: Facts and Fantasies	2007	CLA promotes a culture of evidence-based assessment.
28	Mongkuo, Maurice Y., & Mongkuo, Meya Y.	Testing the Factorial Equivalence of the Collegiate Learning Assessment Performance Task Diagnostic Instrument Across Lower Class and Upper Class Predominantly Black College Students	2017	CLA uses open-ended question instructions so that students can construct answers towards high-level thinking.
29	Randles, Rebecca, & Cotgrave, Alison	Measuring Student Learning Gain: a Review of Transatlantic Measurement of Assessment in Higher Education	2017	CLA tests students with various information to provide explanations of solution recommendations based on actual problems.
30	Kaniuka, Theodore, & Wynne, Matthew	Exploring the relationship between the Collegiate Learning Assessment, Student Learning Activities, and Study Behaviors: Implications for Colleges and Universities	2019	CLA requires students' ability to solve complex problems by analyzing and synthesizing different information and providing correct solutions scientifically and grammatically.
31	Simper, N., Frank, B., Scott, J., & Kaupp, J.	Learning Outcomes Assessment and Program Improvement at Queen's University	2018	Assessment with the CLA Task presents real-world situations so that students can take a role to address problems, identify solutions, and provide recommendations resulting from the analysis process of existing evidence.
32	Pichette, Jackie, & Watkins, Elyse K.	Learning from the Queen's University Assessment Experience: Considerations for Selecting an Appropriate Skills Measurement Tools	2018	CLA Task is a performance assessment based on open-ended questions, real problems, and problem-based situations.

33	Hyytinen, H., Nissinen, K., Ursin, J., Toom Auli., & Lindblom-Ylänne, S.	Problematising the Equivalence of the Test Result of Performance-Based Critical Thinking Tests for Undergraduate Student	2015	CLA Task presents realistic problems, open-ended questions, and some information, students will solve by organizing, analyzing, synthesizing, and evaluating to compile explanations on problem-solving.
34	Aloisi, Cesare, & Callaghan, A.	Threats to The Validity of The Collegiate Learning Assessment (CLA+) as a Measure of Critical Thinking Skills and Implications for Learning Gain	2018	The evidence presented in the CLA Task should support and evaluate the solution to the problem.
35	Lattuca, L. R., Knight, D., Seifert, T. A., Reason, R. D., & Liu, Q.	Examining the Impact of Interdisciplinary Programs on Student Learning	2017	CLA Task is a way of assessing by assigning work equivalent to higher education based on problems.
36	Shek, D. T. L., Yu, L., Chan, K. H. W., & Ho, W. W. L.	Assessing Learning Gains of University Students in Hong Kong adopting the Collegiate Learning Assessment Plus (CLA+)	2016	CLA as performance assessment is used as an assessment to analyze, criticize, evaluate problems, and compose an essay in reasoned responses and problem solutions.
37	Hopper, Mari K., & Kaiser, Alexis N.	Engagement and Higher Order Skill Proficiency of Student Completing a Medical Physiology Course in Three Diverse Learning Environment	2018	Assessment using CLA task can develop students' skills in high-level thinking such as analyzing, synthesizing, critical thinking, and making students more successful in their learning activities.
38	Repo, S., Lehtinen, T., Rusanen, E., & Hyytinen, H.	Prior Education of Open University Students Contributes to Their Capability in Critical Thinking	2017	Some criteria of CLA Task that can improve students' explanatory abilities, among others: students' explanation of the correctness of the information, explanation of correct logic, description of diverse information, and identifying sources to obtain objective evidence.
39	Simper, N., Frank, B., Kaupp, J., Mulligan, N., & Scott, J.	Comparison of Standardized Assessment Methods: Logistics, Costs, Incentives, and Use of Data	2018	CLA encourages students to engage with real-world problems and can provide solutions. CLA has questions about scientific reasoning, critical thinking, evaluation, giving criticism, and argumentative explanations.
40	Wolf, R., Zahner, D., & Benjamin, R.	Methodological Challenges in International Comparative Postsecondary Assessment Programs: Lessons Learned and the Road Ahead	2015	CLA is an open question-based assignment used to measure high-level thinking skills, such as analyzing, evaluating, problem-solving, and written communication (explanation).

Explanatory Ability

Explanatory abilities are used to express and provide reasoning in terms of evidence, concepts, methodologies, criteria, contextual, and present a reason (Facione, 2015). The explanatory ability relates to a person's criticality to explain why an event or problem can occur and how to solve the problem (Beatty, 2017). Critical explanation capabilities have different components to scientific explanation consisting only of claim, evidence, and reasoning (Mc Neill & Krajcik, 2011), and contrast to the ability to argue (Brigandt, 2016). Critical explanatory abilities are used in response to questions of "why" and "how" relating to existing information and relevant elements to a problem (Palupi et al., 2020). An explanation is not pure science but instead applying some sciences that form a descriptive explanation of phenomena or problems until the results obtained from the solution expressed (Kramnick & Nersessian, 2017).

The difference between scientific explanation and critical explanation ability is a person's way of obtaining explanatory sentences used as reasons (Geelan, 2020). The reason is the main objective of critical explanation capability, so it is necessary to evaluate elements in the preparation (Di Nuoscio, 2018). The way a person composes a critical explanation begins with the preparation of procedures and describing the results. Exploratory capabilities related to facts, cases, and determining solutions (Suwono et al., 2017). Reasoning in explanation requires the ability to solve problems, make decisions, analyze, interpret, or evaluate (Utami et al., 2021) to be understood as a complex process regarding the representation of student thinking (Cabello & Topping, 2020).

An explanation explains the process of occurrence of a phenomenon and its completion (McCain, 2015). Answers in explanation can take the form of narratives that write down reasons, information, and assessments of problems (Roth, 2017). The problems faced in preparing an explanation must be real to find the right solution based on existing evidence (Cristalli, 2019). The evidence listed in the explanation must be found through analysis by stages of scientific methods (Morgan, 2017). Steps of scientific methods are used to analyze information based on facts, conduct reflections, and develop logical reasoning (Serrano et al., 2018). The success of explanation statements related to problem identification and problem-solving (Olmos, 2020). Identification and problem solving are prepared through explanation indicators: justify procedures, state results, and present arguments or explanations (Facione, 2015). Preparation of procedures as an initial explanation capability is carried out by

formulating problems and making a solution plan for problem-solving (Gelerstein et al., 2016). The problem-solving solution plan is identified and explained in more detail in the second component of the explanation, state the results. The results described are about the detailed explanation of problem solutions and convey a description of the results of the solutions stated (Gelerstein et al., 2016). The result of problem-solving is then written in the form of reasoned targeting. The written explanation must have a good reason for solving the problem (Facione, 2015). Answer in explanatory ability consists of claim, evidence, and reasoning (Mcneill et al., 2006).

Questions that improve the exploratory ability include:

What are the findings of the investigation?

How do I analyze?

How do I interpret?

What is the solution to the problem?

Why was a decision made?

(Facione, 2015).

Questions about “the investigation findings” and “how to analyze” are included in the indicators that justify the procedure. Questions about “how to interpret” and “solve problems” are included in the hand state the results. Questions about “the reasons for a decision being made” are included in the hand present an explanation or argument.

Collegiate Learning Assessment (CLA) Task

Collegiate Learning Assessment Performance Task (CLA Task) assesses tasks equivalent to higher education based on problems (Lattuca et al., 2017). Assessment with CLA Task has many alternative answers that students can make to train students' ability to analyze a real and complex problem solving written in explanation (Shavelson, 2008). Writing explanation with CLA Task based on existing evidence (Klein et al., 2007). The evidence analyzed in the CLA Task is obtained from problem-based situations so that students can directly take a role to solve problems, identify solutions, and provide problem-solving recommendations from the evidence analysis process (Simper et al., 2018). Evidence is obtained from the process of analyzing various information that students can collect through existing problems. The evidence must be able to support and can be used to evaluate the assumptions of the stated solution (Aloisi & Callaghan, 2018).

CLA Task as performance assessment has problem-based situations, open-ended questions, and problem-solving (Pichette & Watkins, 2018). The problem in the CLA task is a real and complex problem, so the solution requires scientific reasoning (Simper et al., 2019). Real and complex problems encourage students to solve them with scientific methods to shape students' knowledge through the problems presented. Scientific methods used in solving problems require analysis, evaluation, and critical thinking skills to achieve knowledge (Wolf et al., 2015) (Shek et al., 2016). Knowledge is formed by students inductively, beginning with observations to explain data, compile questions to answer, find problems to solve, and analyze cases (Prince & Felder, 2006).

Students can do case analysis if the question is open-ended (Kaniuka & Wynne, 2019). Open-ended questions are helpful when teachers want a broader and more detailed view of the problem. The answer to the open-ended question has more information and solutions to the problem being discussed (Gupta et al., 2020). The answers given from open-ended questions can bring up different solutions to a problem by conveying accountable reasons. Accountable reasons are written based on evidence from information obtained by students based on the analysis results (Gupta et al., 2020). Open-ended questions in CLA tasks can train students' ability to construct answers towards higher thinking skills, one of which is writing explanations (Mongkuo & Mongkuo, 2017).

Problem-solving is one of the three components of the CLA Task. CLA Task presents real problems assisted by open-ended questions so that students can develop solutions as problem-solving (Pichette & Watkins, 2018). Problem-solving is decision-making to solve problems (Funke et al., 2017). Decision-making involves designing, evaluating, and implementing strategies to answer open questions (Jones & Inglis, 2015). A good solution should be able to identify precisely the problem or phenomenon that is occurring, the obstacles that may arise when it will solve it, and solutions that may be expected to address the problem or phenomenon (Brookhart, 2010). The expected solution to solve the problem can be more than one solution. A good solution prioritizes and evaluates the effectiveness of its strategy to solve complex problems (Brookhart, 2010).

Relation between Explanatory Ability and CLA Task

Assessment of exploratory capabilities should include several characteristics, among others: the application of information available in real situations, conducting cause analysis, and evaluating opinions (Aizikovitsh-Udi & Cheng, 2015). One of the reasons for the low explanatory ability is that teachers cannot integrate the characteristics of critical thinking skills into the learning process (Choy & Oo, 2012).

The learning process by associating materials with real problems can encourage students to develop scientific approaches to improve exploratory skills (Bustami et al., 2018). The association between matter and real problems can be done through scientific practice activities closely related to natural phenomena. Natural phenomena are one of the stimuli students to arrange the explanation (McCain, 2015). The preparation of explanation based on natural phenomena is achieved through the analysis

process using work or assignments that provide students with the opportunity to complete their reasoning process (Larsson, 2017). The process of reasoning students can be arranged as an explanation. Explanation capabilities can be achieved with an assessment model that uses realistic problems, open-ended questions, and some information as evidence (Hyytinen et al., 2015). The type of assessment that supports these characteristics is the CLA Task.

Explanatory abilities have three main indicators: justify procedures, state results, and present arguments or explanations (Facione, 2015). The preparation of the procedure in the explanation is written according to its reasoning and can be done if given an open-ended question (Kurniawan et al., 2018) (Kaplar et al., 2021). An open-ended question is one component of the CLA Task. Open-ended questions can be used to reveal a solution to a real and complex problem (Pichette & Watkins, 2018). Complex problems are needed for students to be able to develop self-learning procedures. The problem required in preparing the procedure is an ill-structured problem, a problem that allows many solutions in its solution (Noer, 2011). Ill-structured and self-learning problems can be found in problem-based learning models (Tan, 2003).

The second indicator of explanatory abilities is to state the results. The result in explanation is problem-solving. Problem-solving solutions must be based on actual problems and disclosed based on existing information or evidence (Povich, 2021). Real problems with evidence of information are one of the components of the CLA Task. Solutions built by students are obtained through scientific methods, starting with observations to explain information, compile questions to answer, find problems to solve, and analyze cases until they can compile results (Prince & Felder, 2006). Stages of scientific methods to investigate problems can be found in the problem-based learning model (Tan, 2003).

The third indicator of explanatory abilities is to present explanations based on students' reasoning. An explanation can be narrative, arranged must-have components claim, evidence, and reasoning. A claim is an idea, opinion, or hypothesis about an event (Kaya et al., 2012). A claim is a statement that answers the phenomenon or problem being discussed (Mc Neill & Krajcik, 2011). A claim must describe an event that occurred or identify the causative factors of an event (M Novak et al., 2009). Evidence is a piece of data to support a claim (Tama et al., 2016). Students prepare evidence of scientific data to maintain an idea or opinion that students have (Berland & Reiser, 2008). The reasoning is a reason that needs to be explained to link claims with evidence (Tama et al., 2016). Reasoning components shape students' understanding that evidence is important and relevant to the claim (Berland & Reiser, 2008).

Claim, evidence, and reasoning are obtained from problems, supporting information, open questions, and investigations conducted by students. The characteristics for finding claim, evidence, and reason are assessed with CLA Task. Claim, evidence, and reasoning organized into an explanation are made independently by students with some instruction assistance from the teacher, and self-learning can be found in the problem-based learning model. Teacher instruction is a technique used by teachers by giving students instructions to achieve learning objectives (Akdeniz, 2016). An additional technique that can be given to problem-based learning models is brainstorming. Brainstorming is a technique based on problem-solving, decision-making, and thinking about the reasons and causes for providing accurate and objective explanations (Hidayanti et al., 2018).

CONCLUSION

Based on the study of literature related to explanatory abilities and CLA Task, CLA Task with problem-based situations, open-ended questions, and problem-solving can assess explanatory abilities consisting of indicators of justifying procedures, state results, and present arguments or explanations. The achievement of the three indicators of explanatory abilities compiled through the CLA task requires the help of a problem-based learning model of instructional techniques in the form of brainstorming. More research is needed on the effectiveness of problem-based learning combined with brainstorming to develop explanations through CLA tasks.

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